Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	**)**	
	)	
A National Broadband Plan for Our Future	**)**	**GN Docket No. 09-51**
	)	

REPLY COMMENTS

OF

Anne Linton, Esq.

Respectfully submitted by,

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SUMMARY

Anne E. Linton, Esq. submits these Reply Comments to request that the Commission recognize the needs of telemedicine in formulating its broadband plan.

In its Notice of Inquiry, the FCC recognized that enabling telemedicine is one of the goals to be achieved through the development of broadband networks in the future. In these Reply Comments, Ms. Linton explains how some of the telemedicine needs of the past have not necessarily demonstrated what will be demanded of broadband networks in the future; it is the future needs that the Commission's plan needs to protect.

Telemedicine, which is a part of connecting healthcare across the nation, will require robust upload connections to move medical data from the periphery of the network to medical experts at centers of excellence. The network configuration is exactly the opposite of a broadcast or download-centric model. In the healthcare setting, large volumes of data move from the edges of the network in to the center. That data includes medical record information, patient monitoring information from heart, pulse, and glucose monitors, and medical imaging such as digital retina scans, digital x-rays and even digital microscopy. The healthcare community, when it fully adopts the health IT provisions of the American Recovery and Reinvestment Act of 2009, the HITECH Act, will demand tremendous network capacity, and that demand will require data to move into the center and around the edges of our networks, not just from the center out. Farming and aviation users need this new network configuration as well.

These Reply Comments are submitted to urge the Commission to consider these needs as it formulates its Broadband Plan.

REPLY COMMENTS

Anne Linton, principal of Washington Federal Strategies, hereby respectfully submits these Reply Comments in response to the Notice of Inquiry in the matter of A National Broadband Plan for our Future, GN Docket Number 09-51, released by the Federal Communications Commission ("FCC" or "Commission") on April 8, 2009.[1] These Reply Comments respond to the FCC's request for comment on the definition of broadband access;[2] the uses of such broadband access, particularly in rural or remote areas;[3] the use of broadband infrastructure and services in advancing health care delivery;[4] and, finally, how improvements in telehealth and telemedicine delivery can benefit public safety and homeland security.[5] These Reply Comments stress the importance of ensuring that upload bandwidth under the National Broadband Plan is adequate to facilitate – both now and in the future – the public uses identified in the relevant statutes, in particular telemedicine. Specifically, they request that the FCC study the need for, and plan for, robust upload speeds, not just broadband downstream, in our nation's evolving broadband networks.

I. Statement of Interest

Anne Linton submits these Reply Comments as an interested citizen with over eleven years of experience in the field of connected health, also known as a telehealth and telemedicine. Ms. Linton has spoken at numerous conferences on this subject and is the

[1] Notice of Inquiry (FCC 09-31), In the matter of a National Broadband Plan, GN Docket No. 90-51 (April 8, 2009), http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-09-31A1.pdf. ("Notice of Inquiry").
[2] *Id.* at ¶¶ 22-23.
[3] *Id.* at ¶ 53.
[4] *Id.* at ¶¶ 81-85.
[5] *Id.* at ¶¶ 72, 78.

principal of Washington Federal Strategies, which has represented multiple entities before the FCC and provided comments on many Commission rulemakings pertaining to telemedicine technology, law, and policy.

Cost-effective, high quality medical care in the future, especially in rural areas, will rely on telemedicine applications to connect doctors and patients, to share medical records and test results, and to conduct procedures remotely. Telemedicine is a key to bringing real-time medical expertise to communities that cannot support medical specialists on their own. The medical experts cannot provide those consultations without adequate information from the patient's medical record, which will be electronic and need to be uploaded to the medical expert. This data needs to be able to reach the expert in a timely fashion, and that will require robust upload connections. This is what a connected healthcare system will look like.[6]

Telemedicine applications have a unique need for high bandwidth because of their pressing need to transmit data-intensive medical images, digital retina scans, x-rays, ultrasounds, etc., and other patient information while maintaining complete security and data integrity. More importantly, telemedicine applications require that this bandwidth be available both for download and *upload*, a requirement different from that of the consumer market, whose download needs for rich media, etc. far exceed their upload needs. Ms. Linton believes that the FCC should study the future bandwidth needs of telemedicine applications, as well as the need of other public uses of broadband, and use that in determining the appropriate definition of broadband access in the National Broadband Plan. It is for these reasons that Ms. Linton is participating in this proceeding.

[6] The terms telemedicine and connected health are used almost interchangeably herein. It is the future, when we rely on a seamless flow of health information, that these Reply Comments are aimed to ensure.

II. Discussion

A. The FCC Should Plan For Robust Upload Bandwidth To Be Available Under The National Broadband Plan

To accommodate our nation's future data needs, our broadband infrastructure and services will likely need to break from the broadcast-style broadband service model we have today, in which downstream bandwidth is many times greater than upstream bandwidth. While users routinely download large files and rich media, they rarely upload more than emails and requests for more pages and media.[7] Future users, particularly those acting in the public interest in areas such as health care, emergency response, and education, will need broadband access that more closely resembles an office network, in which users frequently both download and upload large amounts of data.

The FCC has correctly identified telemedicine among those public services that the National Broadband Plan must take into account. The American Recovery and Reinvestment Act of 2009 directs the Commission to include in its national broadband plan "a plan for use of broadband infrastructure and services in advancing . . . health care delivery."[8] The Commission has already identified telemedicine as being among the "broad array of public interest goals" to be served by the National Broadband Plan.[9] Further, telemedicine is used in many places to address the needs of people who are underserved by current broadband services and thus explicitly targeted by the National

[7] Many current broadcast-style broadband uses are laid out in paragraph 5 of the Notice of Inquiry, including "finding nearby restaurants, shopping, banking, interacting with government, getting news and information when on the go."
[8] *Id.* at ¶ 84, referring to the American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).
[9] *Id.* at ¶ 9.

Broadband Plan – immigrants, seniors, tribal communities, people with disabilities, people with low income, and rural communities.[10]

Originally, telemedicine linked specialists at established institutions in major cities, permitting them to collaborate over existing broadband networks. Telemedicine today is being used to link rural or remote medical facilities to metropolitan ones so that patients can access medical specialists without traveling long distances. We have only seen the beginning, and the FCC's broadband plan needs to anticipate the future needs, not just to accommodate what has been done before.

The Commission has taken the first step by requesting comment on the "appropriate quantifiable measures for the utilization of broadband in various aspects of American lives, such as … medical care."[11] Ms. Linton commends the FCC for its interest in measuring this utilization as a precursor to setting the National Broadband Plan. Medical care, particularly telemedicine, requires the transmission of large amounts of data, including images, in a secure, reliable, and verifiably lossless format. Thus, any measures adopted by the FCC should plan for both download and upload usage, the utilization of security measures, as well as any signal noise or other degradation that could alter transmitted data in any way. After all, a digital artifact on an x-ray could mean the difference between a clean bill of health, thousands of dollars in additional – possibly unnecessary – testing, or, worse, a missed tumor.

[10] *See Id.* at ¶ 53.
[11] *Id.* at ¶ 33.

B. The Broadband Service Needs Of Telemedicine

The Commission has asked how effective existing efforts at delivering health care via broadband have been, how they can be improved, and to what extent would potential regulations impede or enhance development of a vibrant nationwide telehealth network?[12] To date, broadband networks in the US have not been adequate for healthcare needs, unless the healthcare providers have had deep pockets to pay for expensive telecommunications network connections. This must change in the future because, as the examples below show, a large proportion of the information in telemedicine flows upstream, from the rural outposts or patient homes to the major medical center. Widespread telemedicine applications have struggled to date because existing broadband connections are limited and, more importantly, when available, they offer robust download speeds but severely limited upload speeds – a fact borne of the perceived consumer demand the networks were designed to serve. In response, some telemedicine professionals have turned to expensive satellite communications as a solution. (Some telemedicine projects simply gave up, in despair.) The current approach, just charging more to healthcare, is not economically sustainable. The FCC should carefully study, and plan for, the future data needs of telemedicine applications. By providing them with sufficient bandwidth through wired and wireless channels, the Commission's National Broadband Plan can have a direct and immediate impact on health care delivery by lowering the cost and thus increase the availability of health care to those in remote areas and to underserved populations.

[12] *Id.* at ¶ 84.

1. The Previous Paradigm Of Telemedicine: the Mayo Clinic Example

Mayo Clinic in Rochester, Minnesota is world-class facility for the treatment and care of patients. The Clinic implemented a program that embodies the commonly understood telemedicine solution: medical professionals in fixed, urban locations using broadband services to coordinate their efforts. Communications are sent from medical expert to medical expert over existing, robust broadband infrastructures. For Mayo Clinic, cost was not a particular issue.

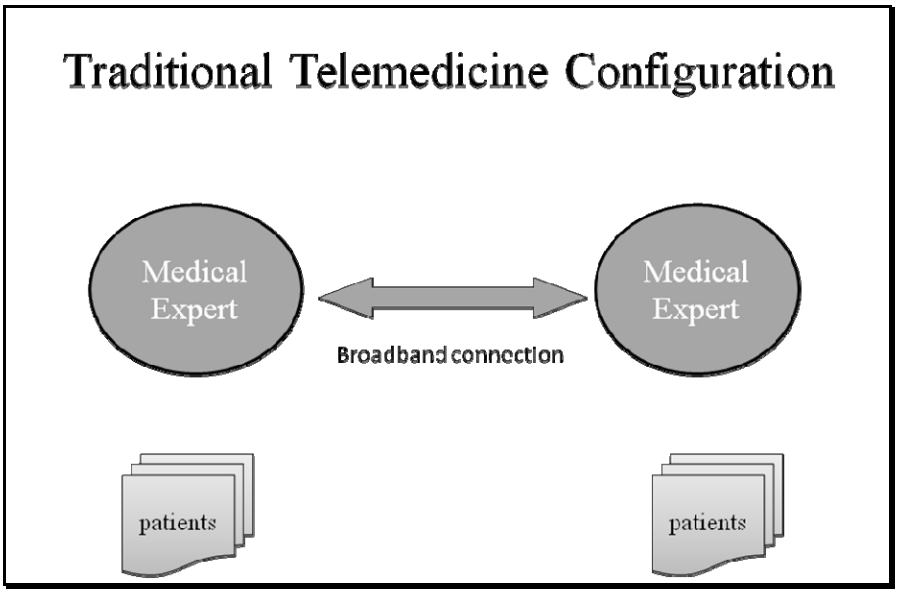

Figure 1. Traditional Telemedicine Configuration

In the 1990's, the highly-regarded Clinic set up clinics in Jacksonville, Florida and Scottsdale, Arizona, and established broadband telecommunications links among them. Mayo Clinic physicians used the links to consult each other regularly, sharing x-

rays, MRIs, CT scans, pathology images to diagnose and treat patients. The large digital images were shared among the three medical centers, permitting doctors to get an expert consult quickly and efficiently.

This stage of telemedicine technology benefited urban residents, whose care improved through the pooling of medical knowledge. The technology, however, was limited to urban areas, with their more robust, wired networks and did not affect the care of those living in rural or remote areas. Even in urban areas, this approach left out low-income patients in most cases.

2. The Present: Remote and Mobile Telemedicine

In one of the first remote telemedicine breakthroughs, in 2002, physicians at Massachusetts General Hospital ("MGH") in Boston, Massachusetts lent their expertise to enable emergency knee surgery at the South Pole.[13] The physician on station at the South Pole did not have the experience necessary to perform the complex knee surgery needed to help an injured meteorologist. Conditions at the South Pole made it impossible to get the patient to a medical facility with the experts needed to perform the surgery until months later, by which time the damage to the patient's knee would likely have been irreparable. Using a cyclical six-hour window of broadband satellite access, experts at MGH trained and guided the local physician through the surgery using video chat. The availability of high-resolution video made it possible for experts at MGH to properly assess the damage in the man's knee and to guide the inexperienced doctor through the surgery, all without leaving Boston. This remote delivery of care was only available

[13] "First telemedicine surgery at U.S. South Pole base is a success," iHealthBeat, July 22, 2002, http://www.ihealthbeat.org/Articles/2002/7/22/First-telemedicine-surgery-at-US-South-Pole-base-is-a-success.aspx, citing an article from the Baltimore Sun.

because the station at the South Pole was able to provide sufficient information over its satellite link from x-rays, medical records, and video to allow the MGH experts to guide the local care. This is a great example of what has been done, but to expand this model will take broadband connectivity, with robust upload capacity, everywhere.

Here in the U.S., remote and mobile telemedicine has already been used in low income, rural, and tribal communities. For example, the Indian Health Service has deployed a mobile mammography van to screen for breast cancer in under-served populations.

In the late 1990's the University of California provided digital mammography services using a mobile clinic without broadband access. The van conducted scans during the day in low income population areas and returned to the hospital at night to download the images. The delay in reporting results to patients made follow-up tests difficult to conduct and lowered compliance rates.

In 2006 alone, the University of Michigan interpreted over 500 mammograms from the Indian Health Service's mobile clinic operating in North and South Dakota. The satellite uplink permitted the mobile clinic both to upload the files – which can top 60 megabytes each – and to receive an expert's reading within 50 minutes. Ideal weather conditions could cut the time from test to reading down to 30 minutes. Over 70% of women whose initial screenings indicated the need for additional imaging were able to receive it immediately, improving compliance. Many of these patients reported previously having to travel up to 100 miles to receive similar testing. Currently, this mobile clinic is also providing diabetes screenings. The potential for what can be accomplished with mobile telemedicine is almost unlimited, if sufficient bandwidth is

available to move information from the mobile clinics to the appropriate health experts and to get essential information back.

Figure 2. A mobile digital mammography clinic.

3. The Future: Web-enabled Telemedicine

As the cost of hardware goes down and the bandwidth available goes up, telemedicine applications can be deployed more widely, from rural communities to urban community centers to individual homes.

In rural communities and remote locations, telemedicine could help turn a set of simple medical devices and a video conference link into a fully functional regional medical center. Staffed by a nurse or EMT trained to perform simple medical tests, these regional centers can leverage medical expertise located hundreds if not thousands of miles away. Diagnoses at these centers can help patients distinguish between the common cold, which can be treated on site, and a complicated bronchial infection that requires several hours of travel to the nearest hospital that could save a life. Such

regional centers can improve public health and reduce costs to both patients and, consequently, taxpayers.

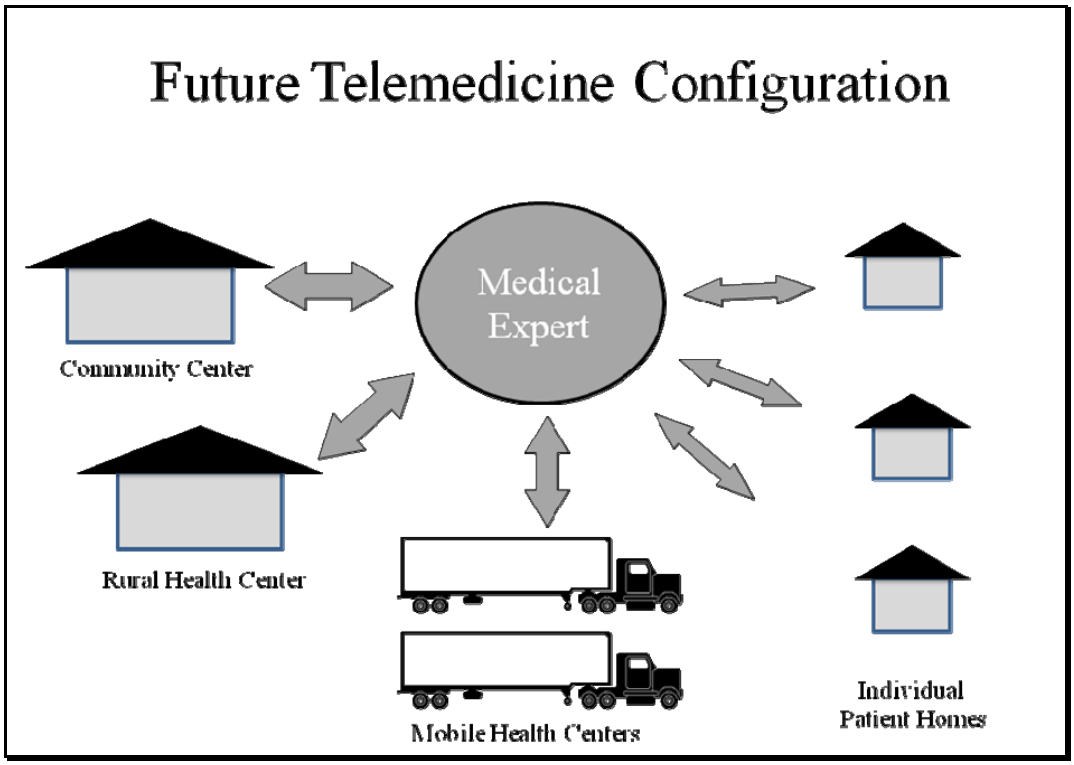

Figure 3. Future Telemedicine Configuration

Many Americans have had a traveling nurse draw blood or record vital signs at their home or office when signing up for life or health insurance. Current network configurations do not plan for that traveling nurse to upload patient information into an electronic health record immediately, but that will be what happens in the future, if the FCC plans for the broadband connections necessary. This will be connected health: having medical information and expertise move seamlessly and securely through the network, so that patients can receive the best care based upon the best information. Only with adequate, cost-effective broadband connections allowing for this sort of data upload

all over our country can we reap the benefits of connected health. With ubiquitous broadband, a host of traveling care givers, delivering medical tests to patients in convenient locations while transmitting the results for immediate screening, diagnosis, entry into an electronic health record, and providing timely feedback and response will help us to respond to medical crises and enhance the effectiveness of those medical encounters. This rebirth of the house-call could reduce time lost at work, while the convenience could encourage more people to seek medical assistance – saving money and improving public health.

The elderly, the chronically ill, and the handicapped can use future telemedicine applications to remain in their own homes, avoiding the stress and costs of assisted living facilities. Such persons could use network-enabled medical devices, ranging from blood glucose monitors to full-time heart and respiratory monitors, to monitor their medical conditions in real-time and transmit the data to health care providers. Providers would get better, more comprehensive patient data than they do during patients' short, periodic office visits allowing for timely interventions that may prevent costly hospitalizations. Further, providers could help keep costs down by monitoring multiple patients at once remotely – not unlike what is done at modern nurses stations in hospitals. Finally, patients would gain freedom and save time instead of constantly heading to and from the doctor's office. Already, the Veterans Administration (VA) is seeking more ways to allow veterans to retire in place, and the VA is counting on connected health to help.

As with previous telemedicine applications, patient data, test results, and images in future telemedicine applications would flow mostly upstream, from the patient, at the periphery of the network, to the provider, instead of downstream, from the provider to the

consumer. The FCC should focus on this need for upload capacity as part of its National Broadband Plan.

4. Additional Applications

Telemedicine applications in the form of fixed regional health centers or mobile platforms can serve multiple purposes. The Commission has asked for comment on how telehealth and telemedicine through broadband can advance public safety and homeland security.[14] The Commission has also asked how the development of an interoperable public safety broadband network could contribute to that goal.[15]

Whether fixed or mobile, telemedicine platforms deployed in remote or rural communities will contain, must contain, robust communications systems, capable of transmitting and receiving data, voice, and video that could prove valuable in the furtherance of public safety and homeland security. For example, local fire, police, paramedics, and state and national guard members could be trained to convert a telemedicine platform into a command center in case of natural disaster, attack, or civil unrest, using it to communicate with other first responders as well as state and federal officials.

The technology and network configurations implemented in a mobile telemedicine clinic can be adapted for educational use as well. This will make distance learning more cost-effective, with a greater level of interactivity because of the higher resolution of the video interaction. The result will be a higher educated population and more robust rural communities because more talented individuals will feel they can still

[14] Notice of Inquiry at ¶ 72.
[15] *Id.* at ¶ 78.

access rich educational experiences. Current video conferencing can permit students in a rural school to participate in lectures on math or literature or dissections taking place in a biology class hundreds of miles away. But, current network constraints do not allow those students to have the level of interactivity that makes the educational experience rich, because they face bandwidth constraints. The video downloaded is rich, but the link leading back up is not sufficient to allow the teacher at the other end of the link to see what additional instruction is required.

5. Other Demand For Robust Upload Capacity

a. American Farmers:

Today, America's farmland is farmed by a combination of family farmers and corporate farming interests. While the number of family farms has been shrinking for decades, there is a resurgence of demand for farm products from smaller, more local farms. Internet-enabled local organic farms can now ship fresh, ripe produce directly to customers. However, for this business model to work, the farming enterprise needs to have adequate bandwidth allowing the farm to upload photos of what is available and other timely data that allows it to sell perishable items to its customer base. This business model takes bandwidth, delivering large volumes of data from the periphery of the network toward the center, not the other way around. Not only will this strengthen our rural communities, but it will also protect our food supply.

b. Aviation:

In light of the terrible tragedy of Air France Flight 447 which was lost over the Atlantic in June 2009, there has been another reexamination how to get the data from

"black box" to determine what happened in the event of an airline disaster. The question arose recently why not stream data out of the black box? In part, the constraint is bandwidth. Why are we not configuring networks in such a way that it is possible to use broadband technologies that would help make this data available when it is needed? The system design should take into account the volumes of data to be transmitted, and perhaps the data from a flight could be erased at the successful end of the flight, but it seems absurd that we are not even considering a broadband plan that makes sufficient bandwidth available for uses like this.

C. The FCC Should Define Broadband Access So As To Require Greater Parity Between Available Download And Upload Bandwidths

The FCC correctly identified its fundamental charge under the American Recovery and Reinvestment Act with regard to broadband as follows: "How should broadband capability be defined going forward, and what does it mean to have access to it?"[16] Paragraph 17 of the Notice of Inquiry requests comment on the definition broadband, suggesting that one possible definition is the "capability to download a certain type of media in a certain amount of time." This is a partial definition of broadband.

Based on its study of the needs of telemedicine and other public interest applications, the FCC should consider a more complete definition, which includes a user's ability to contribute to the network by uploading data. Ideally, the definition would do away with the distinction between download and upload speeds and state that users in a broadband system must be able to transfer (that is, in either direction) a certain quantity of information in a certain amount of time.

[16] *Id.* at ¶ 13.

Further, the Commission requests comment on whether this definition of broadband access should be static or dynamic, with speed tiers that adjust with changes in technology.[17] It seems clear that a National Broadband Plan that sets out goals over even five years must be based on a dynamic definition. If one looks back to thirteen years ago when the 1996 Telecom Act was passed, the limitation on support for rural telemedicine under the Universal Service program to a T-1 speed was out of date within three years. Only a dynamic definition of broadband can accommodate the innovation that even the near-future will bring.

One possible purpose of setting static definition for broadband access would be to set a speed or bandwidth goal for the industry. While this might be necessary to spur innovation in areas such as energy or environmental conservation, the broadband industry continues to innovate rapidly on its own. As such, a static definition could, at best, be unnecessary, and, at worst, create an artificial 'cap' on innovation. The Commission appears to have realized precisely this when it states in paragraph 22, "With technology developing at such a rapid pace, it is important that we do not lose sight of the potential for monumental shifts in technological platforms that would render definitions obsolete or indeed harmful to developments that might otherwise take place in the market."

III. Conclusion

Telemedicine has proven its value by connecting underserved populations to world-class health care through the transmission of high resolution images, videos, and other medical data for review by expert medical personnel. As the FCC establishes the framework for our nation's future broadband infrastructure and services, it should ensure

[17] *Id.* at ¶ 18.

that telemedicine will evolve into comprehensive connected health, extending high quality health care to all Americans. This requires studying the current and future bandwidth needs of telemedicine applications, keeping in mind the need for significant upload bandwidth. The entertainment downloaded over our current network configuration is great, but when it comes at the cost of designing networks that can provide us with significantly important uses such as connected health and telemedicine, real-time aviation status updates or viable farming or rural entrepreneurship, do we really want to make policy decisions that favor the current configuration over network configurations that allow for the demands and innovation of the future? I hope not.

Should the Commission determine that telemedicine, connected health, distance education, farming, and other public services require greater parity between the upload and download capacities in the broadband infrastructure, it should define "broadband access" to require it.

Respectfully submitted,

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